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A Pre-Requisite to Re-tooling

A salutary warning has been given to industrialists by the new publication of the Tory Reform Committee, called "Tools for the Next Job," that they must pay immediate attention to what amounts to the mechanisation of the means of production. It is obvious from an examination of some of the crude toys placed on the market recently at ridiculously high prices, that during any period characterised by a plethora of loose money and a general shortage of consumer goods, sales of goods can be made. This, taking the long view, is unsound, and it is preferable to deflect national resources to the production of modern tools, which, when intelligently utilised, will increase output per man-hour.

It has been stated by "The Economist" that if the normal 1½ per cent. annual increase in wealth produced per hour by the British workman were increased to 2½ per cent.—this in order to double the standard of living within a generation—then to attain the level of production now reached in the United States it would take another 30 years. These comparisons with American efforts are, to our mind, entirely useless, as the U.S.A. is virtually a continent and the United Kingdom a country. One large steelworks in America will have an output equal to the whole of the United Kingdom. Again, the entire motor-car production of this country scarcely equals the output from one of the great transatlantic plants. Naturally, possessing such a large home market, mechanisation can be carried to the utmost limits. A fairer comparison is to take two works of similar size making a similar line of goods, and here sometimes we must hand the palm to the Americans and sometimes retain it for our own plants.

The working out of national efficiencies is but of academic interest, whilst, on the contrary, the inculcation of truly efficient operation of every plant, shop and machine will produce worthwhile results nationally and be felt internationally. Public opinion is undoubtedly "sold" to the idea that industry must be efficient. Delegations are constantly crossing the Atlantic in both directions to study the increased use of women labour, the application of machinery to mining, and so forth. Thus it appears that the best way to formulate plans for the better conduct of industry is to see what other works are doing. This being established, we ask all the Government departments concerned to lift the ban on works visits by technical associations and the like, in so far as this can be done without endangering national safety and the war effort. Here and there permission has been given by the more enlightened Service departments, but their good sense has been frowned upon by other Government officials. There is much evidence that plants which for the war period have been fully employed on munitions have acquired much information of general value to the industry, and these firms are usually not unwilling to receive organised parties of technicians to inspect their efforts, reinforced as they are by new installations.

If re-tooling be an essential to post-war progress, then surely a necessary step is to permit those charged with its implementation to see what is currently available, and do this before curtailment of Government contracts converts a good plant into a mausoleum.

PUBLICATION RECEIVED

Creosote-Pitch Mixture. Issued as Fuel Efficiency Bulletin No. 36, by the Ministry of Fuel and Power, 2, Little Smith Street, Westminster, S.W.1 (gratis on application).

This is an excellent piece of work, and would have been of the greatest use if it had only been available about four years ago. The note that high alumina refractories give better service with this fuel than high silica material is useful information. A note about sulphur pick-up would have been welcomed.

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FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

MARCH 17.

Institution of Mechanical Engineers:—Graduates' Section, London, annual lecture. "British Machine Tools During the War," by A. H. Lloyd, B.Sc., M.I.Mech.E. At Storey's Gate, St. James's Park, London, S.W.1, at 3.30 p.m.

MARCH 23.

Keighley Association of Engineers:—Ladies' Night. "Highland Harvest," by G. B. Kearey, F.R.P.S., F.Z.S. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Manchester Association of Engineers:—Annual general meeting, followed by Paper on "Gear Cutting," by A. S. Rowley, B.Sc.Tech. At the Engineers' Club, Albert Square, Manchester, at 6.30 p.m.

MARCH 24.

Sheffield Metallurgical Association:—Joint meeting with the South Yorkshire Section of the Royal Institute of Chemistry. "The Principles Governing Corrosion Resistance in Metals and Alloys," by Dr. U. R. Evans. At the Sheffield Metallurgical Club, 196, West Street, Sheffield, 1, at 2.30 p.m.

APRIL 13.

Institute of Metals:—Joint meeting between the London Local Section and London Section of the Society of Chemical Industry. At the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, at 7 p.m.

Institute of British Foundrymen

MARCH 23.

Middlesbrough Branch:—Annual general meeting, followed by a report on the activities of the Technical Council and Sub-Committees by J. E. Mercer. At the Cleveland Technical Institute, Corporation Road, Middlesbrough, at 6 p.m.

MARCH 24.

Birmingham Branch:—"Malleable Cast Iron," by A. B. Peace. At the James Watt Institute, Great Charles Street, Birmingham, at 2.30 p.m.

East Midlands Branch:—Annual meeting. Short Paper Competition. At the Technical College, Derby, at 6 p.m.

MARCH 26.

Sheffield Branch:—Joint meeting with the Iron and Steel Institute. Discussion of the Report of the Foundry Practice Sub-Committee. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

MARCH 28.

London Branch:—"Gating, Risering and Chilling of Magnesium Castings," by A. Cristello. Exchange Paper from the Metropolitan Chapter of the American Foundrymen's Association. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

APRIL 7.

Wales and Monmouth Branch:—Works visit to the Tubal Cain Foundry and Engineering Works, Limited, Cardiff, at 2.45 p.m. Followed by a lecture at the works on "Phosphor-bronze Worm Wheel Blanks," by A. Hopwood.

DR. ZAY JEFFRIES, a technical director of the General Electric Company, in a recent address pointed out that iron, steel, aluminium and magnesium would be available in almost limitless quantities in the post-war period and, with improvements in their technology, were likely to dominate the metal trades after the war. On the other hand, copper, lead and zinc might in time become semi-precious metals.

DETROIT FOUNDRY CONGRESS CANCELLED

The 1945 War Production Foundry Congress of the American Foundrymen's Association, scheduled to be held in Detroit from April 30 to May 4, has been cancelled. Although the meeting was to have been devoted exclusively to the presentation of technical Papers and reports valuable to the production of castings for war purposes, the Association's officers have voted for the adoption of an emergency programme to accomplish its aims with minimum use of transportation and hotel facilities.

In a telegram to the Director of War Mobilisation, Mr. James F. Byrnes, Mr. Ralph J. Teetor, President of the A.F.A., stated that, notwithstanding the virtual completion of plans for the Annual Meeting and War Production Foundry Congress of the American Foundrymen's Association, the board of directors had voted to cancel this meeting.

"While the national meetings of the Association now are directed primarily to aiding the more effective production of castings for war purposes, we believe that these purposes may be effected through processes involving no large gatherings and through the full utilisation of avenues now open for consultation with Army and Navy ordnance," he added. The Association would continue and extend its work in the interest of war production through every available means. "Recognising the necessity for minimising travel during this crisis, we are in full accord with your programme and unanimously subscribe to your request," Mr. Teetor concluded.

FOUNDRY SERVICES, LIMITED

The announcement in our issue of February 22 to the effect that an agreement had been concluded between Foundry Services, Limited, of Long Acre, Nechells, Birmingham, 7, and Minerals Separation, Limited, of 10, Old Jewry, London, E.C.2, might be construed by some readers as an indication that the latter concern is supplying the various compounds with which the name of Foundry Services, Limited, has been associated for many years.

It should be stressed that the arrangement entered into by both companies concerns only the manufacture of "Foseco" products and that customers of Foundry Services, Limited, are not in any way affected. This company will continue exclusively to market "Foseco" products and to offer that service to the foundry industry generally which has been a feature of its activities in the past.

REPRESENTATIVES OF THE Turkish State Railways have, it is understood, placed orders for nearly £1,000,000 worth of railway materials with Sheffield firms. The orders are mainly for tools and tool steel, and have been placed with Arthur Balfour & Company, Limited, Edgar Allen & Company, Limited, and Thos. Firth & John Brown, Limited.

USES OF GASES IN THE FOUNDRY*

Utilising town's or producer gas for heating and drying

By HAROLD HAYNES

It is not the intention of the Author to deal with gases from a scientific or theoretical standpoint, but rather to try and explain the general application and practical manipulation of tackle when operating under varying conditions. Either town's or producer gas can be applied in the foundry for heating or drying purposes with very satisfactory results, once the pipes have been laid down. The gas is drawn from the main through a purifier by means of a power-driven booster and delivered to the combustion point under pressure.

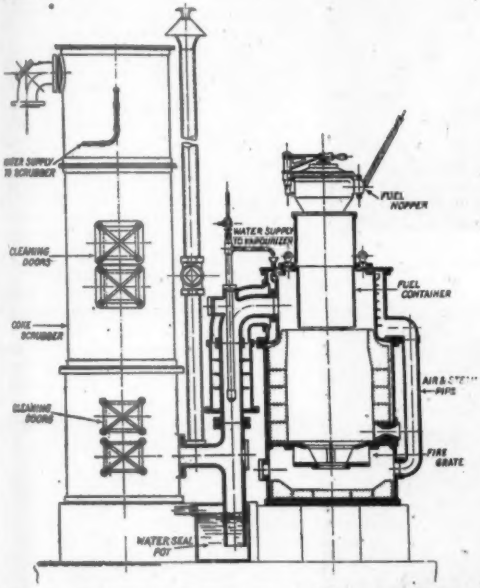

FIG. 1.—SECTIONAL ELEVATION OF NATIONAL CONICAL GRATE DESIGN GAS PLANT.

After much personal experience with many methods of drying moulds, cores, and the like, the Author is of opinion that gas under pressure is a foundry asset. It is simple to adopt and any gas engineer would be only too pleased to give details. In the Author's foundry, producer gas supplied from the works' gas plant is used. Gas has been available for foundry work for a good number of years, but full advantage has not been taken of it on account of cost. This is thought to be the drawback, but when examined in its widest aspect, gas is not expensive in the long run, whilst satisfactory and reliable results are obtained.

Gas is clean and simple to apply to moulds, stoves, ladles, cores, furnaces and numerous other jobs where drying or heating are concerned. Neither dirt, ashes, smoke, nor damaged moulds caused by coke dropping on rammed faces are to be associated with gas heating. Scabs can usually be prevented by a few minutes' drying of damp places in the moulds, whilst broken cores can be mended and dried in a few minutes by gas flame. A plant worthy of consideration in the modern foundry is the gas producer, such as is shown in Fig. 1. This consists of a gas generator, scrubber, gas purifier, exhauster and pressure regulator. After the plant has been started up, the only labour necessary is for the purpose of refilling the hopper with fuel, which is required once every two or three hours and occupies but a few minutes. The plant can be started up quickly from a cold condition, is easily accessible for cleaning purposes and, generally, so designed that it can be understood and attended by unskilled labour.

Installation of Gas

There is no need for any complication in the installation. Gas is led from the booster by 3-in. pipes running under the crane girders, and 1-in. branch pipes follow down the pillars. About 4 ft. from ground level there is a gas cock and a coupling for connecting up to a flexible rubber pipe which carries the gas to pipes laid out for the mould which needs drying. This can be done by a handy man, who can be fixing the necessary pipes while the moulder is finishing the mould. The pipes needed for the moulds are 1-in. dia., in standard lengths ranging from 4 ft. to 1 ft., with bends, tees, elbows and couplings. The pipes are drilled with holes ¼-in. dia. and about 3 in. apart. The pipes should be set at about 9 in. from the face of the mould. Moulds can be dried in the floor, in boxes or from moulding machines; they can be skin dried to keep a few days before casting; in fact, this can be arranged easily and at small cost.

In the drying of the mould, the gas is passed over the top of the mould by means of a wrought-iron pipe. In the case of a deep job, the reason for doing this is that the gas is to some extent pre-heated before final combustion takes place, *i.e.*, the gas goes down to the pipes drilled with ¼-in. holes.

A mould for a crank case for an oil engine, 10 ft. by 4 ft. by 3 ft., can be dried thoroughly by means of

* A Paper read before the Lancashire Branch of the Institute of British Foundrymen, Mr. A. Hopwood, presiding.

Uses of Gases in the Foundry

gas in approximately 2½ hrs. During the process of drying the mould is covered over with the cope supplemented by corrugated-iron sheets, which allows air to enter the mould. Producer gas is supplied to service pipes running throughout the foundry.

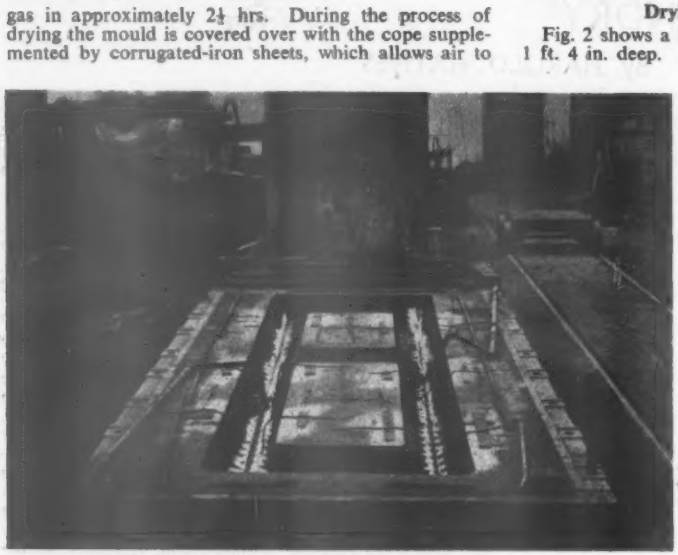

FIG. 2.—DRYING MOULD FOR R.A.6 BASEPLATE (BOTTOM).

FIG. 4.—STOVES AND CORE-DRYING TROLLEYS.

Drying a Large Baseplate

Fig. 2 shows a baseplate 14 ft. long by 4 ft. wide by 1 ft. 4 in. deep. It illustrates how the mould is dried with straight lengths of 1-in. dia. pipe. While drying, the moulders core up the top part and, by the time this is done, the mould is dry and can be cast the same day. This mould is wet-blacked and sleeked over and then washed over with salt water. The facing sand used for this job is made up from:—Black sand, 60; red sand. 35; and spent hops, 5 per cent.

When drying by gas, only a few minutes are required to fix up the pipes and light off, and then 3 hrs. are taken to dry the job. This saves a great amount of time as against stoving a mould or arranging coke fires to dry the mould. Two moulders make and cast two of these in a week.

Fig. 3 shows a mould for a frame 10 ft. by 8 ft. by 9 in. deep. This mould, which has a large surface for the metal to run over, is dried first on the bottom, during which time it is covered over with metal sheets. At the same time the top part is being finished and is later put over the bottom to be dried. This takes about 3 hrs. to dry. This casting must be free from scabs or other defects. The sand used consists of:—Red sand, 45; black sand, 45; and spent hops, 10 per cent. This mould is wet-blacked and washed over with salt water. Two men make five castings in 11 days.

Drying Stoves

Fig. 4 shows part of a battery of core stoves 6 ft. long by 5 ft. 6 in. high by 4 ft. wide, with two gas pipes running along the bottom of the stoves. These pipes are 1-in. dia., with holes varying from ⅛ to ⅜ in. drilled every ½ in. Cores are placed on specially built racks and put into the stoves by a truck. The time required to dry one load of cores is 1½ hrs.; if the cores are wanted urgently, there is a stove for that purpose which dries in a few minutes.

The advantages of gas-fired core ovens is, primarily, the

small amount of attention required; once the gas is ignited, there is no need for further supervision until the oven has been raised to the necessary temperature, when the gas can be turned down sufficiently to bake the cores. Of little less importance is cleanliness, as no dirt, dust or ashes can accumulate and the cores are much cleaner when removed.

The sand used for all oilsand cores is returned sand from the dressing shop, which is quite satisfactory. The sand, which consists of 4 bucketsful of sand from the dressing, 1 bucketful of sea sand, and 6 lbs. of oil, is mixed by a machine. About 80 per cent. of the oilsand cores are made from black sand from the dressing shop.

Oil-engine Bedplate

A casting regularly made is a large eight-crank oil-engine bedplate. The mould is 24 ft. long by 6 ft. wide by 4 ft. deep. To core up this mould approximately 15 tons of cores are required, so that means a great number of staple holes to make up; also 4-in. square bolt holes. It is important these cores should be dried and any method other than by gas would be costly. This casting must be free from blowholes and scabs, as it must withstand oil pressure. Making up all the holes with green sand is not safe in such jobs where a great amount of metal lies on the face, so a few minutes' drying makes the job safe. The labour saved is a great factor in getting the work through quickly.

As the moulder cores up at one end, the handy man comes along and dries the holes; this saves time which is essential on jobs that take three days or more to core up. Gas under pressure is beneficial in this way; when a mould is cored up and ready for the top to be put on, the man can go round the mould and eliminate all damp places. By this means very satisfactory results are obtained.

FIG. 3.—BOTTOM PIECE OF MOULD FOR TRANSPORTER FRAME JIG.

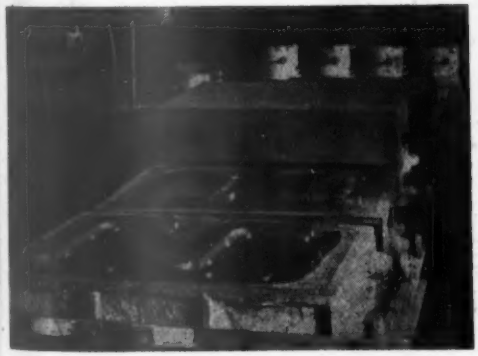

FIG. 5.—CANOPY FOR SURFACE DRYING OF MOULDS.

Drying Machine-made Moulds

A canopy is arranged on the roller conveyor; where

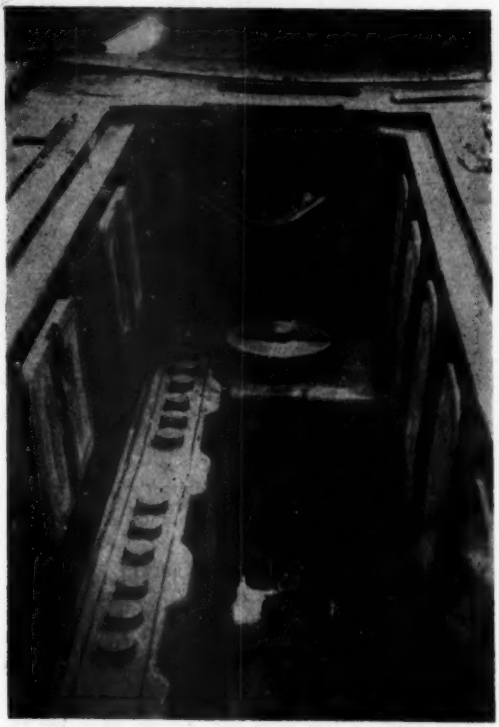

FIG. 6.—MOULD FOR B.A.6 COLUMN.

Uses of Gases in the Foundry

the moulds leave the machine and want drying, they are simply rolled under the canopy, and in a few minutes a mould is dried. These moulds are wet-blacked. The moulds are made in standard boxes 3 ft. and 4 ft. square. This system can be arranged at the end of every moulding machine.

The arranging of the canopy (Fig. 5) is very simple, being made box-like from sheet iron. A space of 1½ in. should be allowed between the canopy and the moulding box, so that the latter can be taken in and out. The canopy should be lined with asbestos packing in order to retain heat. The gas pipes needed are 1 in. running full length, with $\frac{1}{16}$-in. to $\frac{3}{16}$-in. holes about ½ in. apart. This method of drying has proved to be a success, especially for skin drying. As fast as moulds are made and finished on the machine, they are dried and ready to be cored up and cast the same day.

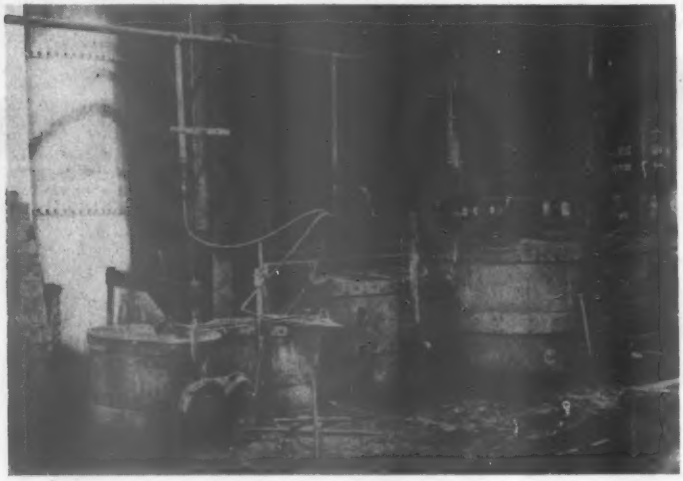

FIG. 7.—BATTERY OF LADLES FOR DRYING.

Drying a Large Column for an Oil Engine

The mould shown in Fig. 6 is 24 ft. long, 5 ft. 6 in. wide by 8 ft. deep. This is a most intricate casting to make, and it is important that the mould should be well dried on account of the depth. About 20 tons of metal are required to cast this job. The number of cores is 92 (approximately 20 tons of cores), so the amount of drying necessary is great. This casting must be free from any defects, as it has to withstand oil and water pressure. The moulders find producer gas very convenient in getting everything dry. As the cores are built on top of one another, there are a large number of staple holes to make up and a jet of flame from a 1-in. gas pipe played on to the parts required will dry these in a few minutes. This frees the moulders to core up and no time is wasted in arranging other ways and means of drying these places. The ease of handling the gas-drying apparatus enables work to be carried out quickly and safely, and the moulders are more satisfied with their work when they know everything is well dried. An important point is that everything is clean.

Ladle Drying

For ladle drying, a flexible pipe connected to the main runs along to specified places; a 1-in. gas pipe is made into a tee to suit the size of ladle. Uniform and quick heating are ensured by putting a light corrugated sheet over the ladles. It should be emphasised that use of gas for drying ladles will help considerably to eliminate smoke in the foundry. Many troubles associated with coke or coal drying are obviated.

Sesci Furnace Practice

This plant is fired with bituminous or soft coal for the first 20 min., followed by a mixture of soft coal and anthracite and then carried on with anthracite only. These coals go through the pulveriser and are then sent up to a hopper which feeds the combustion chamber. The metal melted in this kind of furnace is refined pig-iron for re-use in the cupola also high-duty iron of closely controlled composition and any desired carbon content, so it is essential that the furnace is lit off quickly. It is most important that the metal should be melted in a given time, and a gas flame is very useful in getting the furnace going. Producer gas under pressure is used, and this saves much time in lighting.

An 8-Crank Gas-engine Bedplate

Recently a large bedplate was made entirely by two moulders, including core irons and cores. They put the main cores in whilst the mould was green; all joints were made up and staple holes, etc., provided. Then gas pipes were put in the mould and covered over with sheets; this mould was dried with producer gas taking 6 hrs. After the mould was dry the remainder of the cores were set in the mould. It was so dry that the moulders could walk about the mould. It kept dry for four days before casting. Everything was free from dirt and time was saved in the dressing

shop, there being no fins at the joints; these were made up before drying. The saving of time in the dressing shop is an important factor in the cost of castings, especially such large castings as this. The casting was neat and free from defects.

Gas for Kindling Cupolas

Much of the labour, trouble, and smoke nuisance of this operation can be avoided by the employment of gas torches. Two kindling tuyeres are provided on

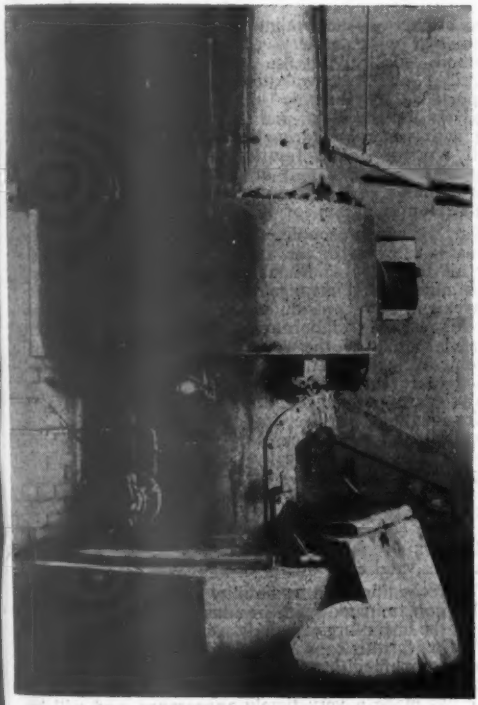

FIG. 8.—GENERAL VIEW OF CUPOLA.

opposite sides of the furnace, about 6 in. from the bottom and fitted with external collars fixed to the furnace shell, as shown in Fig. 8.

The collars are connected to the gas and air supplies and are tapered internally to receive the removable burner assemblies, so that gas and air passages in the two parts mate when the burner is inserted in the collar. The burner consists of a body casting, tapered externally to fit closely in the collar, and having gas and air passages leading to two concentric steel tubes screwed into the body, the air being led to the outer tube and gas to the inner. The tubes project to within about 2 in. of the face of the furnace lining when the burner is in position. Slotted lugs are arranged to hold the burner in position when in use and to allow of its quick and easy removal. A hole is provided through the burner body for igniting the gas and for observation purposes.

A Simple Operation

The operation is simple and in about 10 min. after lighting the gas and adjusting the air supply, the coke is burning sufficiently well to enable the gas to be turned off, the air being left on for a further period to assist the burning up of the bed. The time required for this is considerably shortened thereby and the well is thoroughly heated, so that the first metal is almost as hot as the subsequent taps. When the burner is withdrawn, a piece of loam cake is put in for a plug and then the tuyeres are rammed up with sand; cover plates are secured to the collar as a safeguard. The air supply is drawn from the compressed-air mains, though, of course, this could be provided by a small fan using suitable size piping. Town's gas in place of the producer gas which is used by the Author would give a more intense flame, in which case the small amount of wood which the Author uses to assist initial combustion could no doubt be diminished.

Gas Drying of Tap Hole and Spout

A further convenience of having gas at the cupola is for drying the tapping hole and spout. The gas main feeding the ladle drying and heating station has been carried to the cupola and suitable connections were quickly made.

CAST-IRON THREAD GAUGES

Mr. C. C. Taggart, writing in "Metals and Alloys," discusses the use of "G.B." Meehanite for the production of gauges. He has summarised his experience as follows:—

"These special cast-iron gauges being used in the shops of the 'Continental Gin Company' have proved quite successful for both production and inspection purposes. They are economical in a number of ways. First, the time necessary to produce any gauge is considerably less than the time required to obtain the gauge from a gauge manufacturer. Particularly is this true under present wartime conditions. The machining characteristics of Meehanite make it easier and faster to machine than the tool steel conventionally used in thread gauges. Next, the cost of iron castings is less than the cost of tool steel.

"Finally, the most important economy is represented by the fact that Meehanite iron gauges actually wear longer than do steel gauges. This was apparent on the first application of the iron gauges, and personal extensive experience with them since indicates that they have up to 25 per cent. longer life than steel gauges."

BOOK REVIEWS

The Heat-Treatment of Steel. By Edwin Gregory, Ph.D., M.Sc., and Eric N. Simons. Published by Sir Isaac Pitman & Sons, Limited, Kingsway, London, W.C.2. Price 18s.

There are 36 chapters in this book, which runs to 350 pages. This gives some notion of its comprehensive character, yet perhaps it is a little too comprehensive, for no fewer than five chapters—the first five—are devoted to pyrometry. A good many text-books on metallurgy have filled out with one at the back, and surely the time has arrived either to give this subject a text-book of its own or to take it for granted! The sixth chapter deals in a very elementary way with mainly the combustion of town's gas. It does include a little information on recuperation, and here it is stated that the recuperators are called "checkers." This term, it is felt, should be confined to the milling and not the reheating furnaces.

Being a new book some information might usefully have been given about the use of porous bricks to enable all heat to be extracted from the fuel before passing the products of combustion away to the atmosphere. The real worth of the book starts with Chapters VII, VIII and IX, which review and illustrate the more popular types of gas, electric, and oil-fired furnaces used in industry. Much useful and new information is given under the heading of atmosphere control as related to town's gas furnaces, whilst the chapter on salt baths is excellent, and the only practical information not forthcoming is what to do when the pan breaks down and deposits the liquid salts on the floor! This is not written in anything other than a serious view, as there was a plethora of accidents early in the war. The high standard now reached is well maintained in the subsequent chapters.

Readers of this Journal will naturally be interested in the heat-treatment of steel castings. There are two widely separated chapters devoted to this subject, the earlier one—Chapter XVIII—covers plain steel castings. It certainly gives information with which the operative should be familiar if he is to take an intelligent interest in his work. The second one—Chapter XXVI—confines itself to low alloy—less than 5 per cent.—steel castings. A useful Table (XVIII) gives the treatment normally employed for ten of the more common types of alloyed steel castings. Two other chapters of major interest to foundrymen are those devoted to permanent magnet steels, and stainless steels, though in the latter case the forged material takes a predominating position. As heat-treatment processes are constantly extending their applications and thereby engaging an ever increasing number of usually very intelligent operatives, the need for such a book as this is obvious.

The authors have rendered an excellent service to an important section of the steel industry by presenting such a wealth of data in a manner so easily assimilated by any technically minded operative.

V. C. F.

The Colorimetric Determination of Traces of Metals. By Dr. E. B. Sandell. Published by Interscience Publishers, Inc., New York. Price $7.00

This is the third volume of a series of monographs on analytical chemistry and its applications, and the first in the series to deal specifically with the subject of metals. The author is Assistant Professor of Analytical Chemistry at the University of Minnesota, and his subject is of very great importance to all metallurgical analysts. The book is divided into two parts. In Part I is a discussion of the general aspects of trace element analysis, and Chapters I to III put into correct perspective the methods available, which include a wide variety of chemical and physical methods, electrolytic, fire assay, colorimetric, fluorimetric and spectrophotometric treatments. The importance of organic reagents in modern trace analysis is made clear, and Chapter IV of Part I dealing with general colorimetric reagents is particularly well written. The frequent use of the symbol γ (gamma) to note a unit of trace elements is perhaps less common in this country than in America. 1 γ equals 1 micro-gram, or 1×10^{-6} grams.

Part II, which occupies the major half of the book, contains a review of the available methods of analysis for all the metals. Metals only are dealt with, and their alphabetical arrangement in this section is very convenient, and contributes substantially to the value of this work for laboratory reference purposes. A careful search of the revised table of International Atomic Weights, 1943, contained in the short appendix, failed to reveal a single metal for which methods of analysis are not suggested. For most of the metals their identification, separation and estimation are described, and in some cases where a choice of methods exists these are critically discussed. The more common metals or those of special industrial importance are given a more detailed treatment, and the Author deals with their estimation in a variety of substances embracing such diverse materials as silicate rocks, water, metallic alloys and ores, biological specimens, and even air.

The recognition of the liability of metals and alloys to be contaminated with residual elements has presented the metallurgical analyst with many problems. Both in ferrous and non-ferrous laboratories the demand for facilities for the determination of trace elements is increasing rapidly. For this reason this book has made a very timely appearance, and will be highly valued in all modern metallurgical laboratories.

The 470 pages of this valuable book are in the bold authoritative style of a writer who is clearly an expert in his field, but this has not prevented the inclusion of references to the publications of over 450 contemporaries. Any difficulty arising from the very short and somewhat incomplete subject index is to some extent compensated by the very long and comprehensive list of contents in the opening pages.

J. E. H.

Midland Electric Manufacturing—Dividend of 10% (same) and a cash bonus of 15% (same).

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

METHODS OF TESTING ENAMEL

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—As fabricators and enamellers of glass-lined equipment for the chemical trade, we were very interested in the Paper, "Observations on the Structure of Acid-resistant Vitreous Enamels for Chemical Plant," by Messrs. Charlish and Heeley, reported by you in your issue of the JOURNAL dated February 15, 1945, and in the following two consecutive issues.

While the writer would compliment the Authors on an admirably conceived investigation, and in particular on the excellent quality of the micrographs, there is one point stressed in the Paper which is of such moment to enamellers and to enamelled-plant users that the courtesy of your valuable space is asked for in order to comment on this important aspect.

The Authors deprecate the use of "wet" test methods, and strongly recommend that high-frequency spark testing of enamel should be carried out. Having had many years' experience of the use of high-frequency testing, the firm with which the writer is associated cannot in the least concur with these conclusions. We contend that over and above the ability to detect flaws, the "Sesco" type of tester will produce flaws in an enamel coating. To illustrate this point the writer conducted the following experiments.

A hole was drilled in a glass plate and over this hole a thin microscope cover glass was fused or cemented. This glass was then placed over a smooth steel surface and the high-frequency spark concentrated over the cover glass. A specimen was thus obtained which synthesised a glass-lined piece of steel with a major flaw which had a covering of perfectly sound and impermeable glass over it. About 90 sec. under the spark was sufficient to fracture the cover glass, which was 0.009 in. thick. By the controlled solvent action of hydrofluoric acid on the cover slips, various thicknesses were obtained, varying from 0.003 to 0.009 in. The very thin glass covers fractured immediately the voltage was applied. Microscopic observations showed that the high voltage used first cracked the glass and finally fused the crack edges into a definite puncture. The micrographs enclosed illustrate this mode of glass breakdown under a high-frequency spark. Similar phenomena have been observed with fused down enamel on steel where a "dimple" or depression occurred.

The Authors observe that no breakdown of the coatings took place when the test was applied for lengthy periods. This is understandable since, in applying the full voltage to an even coating, the distribution of the electric flux is over a comparatively large area, but when applied to a depression or an area locally thinner than the surrounding enamel, the pressure is concentrated at such an area, with the result shown in the micrographs. The photograph shown as Fig. 16 of the Paper is typical of such a puncture, and it is significant that the Authors searched for flaws with the high-frequency tester *before* examining them microscopically.

The bubble structure, so well shown in all the illustrations, is an obvious argument against the indiscriminate use of the high voltage test. This microscopic bubble structure should not cause any uncertainty in the Authors' minds, since it is the opinion of many ceramists that even better physical properties are obtained in a glass lining containing such microscopic discontinuities than in one which is more solid and absolutely free of such a structure.

In using the "wet" electric test, the addition of a small amount of a suitable wetting agent to the electrolite will lower the surface tension of the latter to such a degree that the entrance of the electrolite into the very small cavities by capillary attraction will be facilitated and thus render the test more delicate. Experience of testing enamelled equipment in the field, and reviewing records of plant operating conditions and length of equipment life over a period of years adds nothing that would tend to alter our opinion that, in the hands of the unwary, the high-frequency tester is destructive to thin but otherwise perfect areas of enamel glass.

While this type of tester serves a definite purpose in the enamelling laboratory and plant, we would strongly urge that the above facts be taken into consideration before promiscuously using it in the field.—Yours, etc.,

W. MONTGOMERY,
Chemist and Metallurgist,
Enamelled Metal Products
Corporation (1933), Limited.

Durie Foundry,
Leven, Fife,
Scotland.
March 6, 1945.

THE QUALITY OF STEEL CASTINGS

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I cannot allow the remarks concerning British steel castings attributed to Mr. W. P. Eastwood, in your issue of March 1, to pass unchallenged. Although Mr. Eastwood admits that it is only his personal experiences that have been unhappy, yet, on the other hand, he mentions no more than "two or three foundries" in Great Britain as supplying good steel castings, and conveys the very definite impression of holding British steelfounders as a body in poor repute and of believing that the Americans are much better.

I am aware that certain other purchasers in this country are always prepared to assert that Continental steel castings are better than British. No doubt there is a grain of truth in this opinion, but only to the extent that the products of the best exponents of an industry in one country may well be preferable to those of the weaker brethren in another. There is always a tendency, I suppose, for the export trade of any country to be in the hands of the better firms in it; and the fact that these purchasers make such an assertion implies a tendency on their part to buy by price alone.

It is generally admitted by British steelfounders that a number—too many—of their *confrères* are unreliable and generally satisfied with too low a standard of quality. That they should be able to secure orders, at least in peacetime, may be laid as much as anywhere else at the door of ill-directed buyers. No doubt, however, there are similar black sheep abroad. But to assert, as Mr. Eastwood does, that there are only two or three good steelfounders in this country, and to infer, as he does also, that the general level of quality of British steel castings is far below that of the U.S.A., is (Mr. Eastwood will forgive me) sheer nonsense.

Having spent some three years recently in work under the Government intimately connected with the British steelfoundries, with occasion to examine in substantial numbers and variety steel castings supplied by America and captured from Germany, and with access also to the Reports of British Technical Missions to America and opportunities for discussion with their members, I am, I imagine, in as good a position as anyone for forming a correct opinion; which is, that there are not "two or three," but 20 or 30, steelfoundries in Great Britain whose products, each in their own lines, are fully up to the best contemporary standard of any country in the world.—Yours, etc.,

T. H. SUMMERSON.

Albert Hill Foundry,
Darlington.
March 5, 1945.

EFFECT OF HEAD PRESSURE ON CASTINGS

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I was, and have been for some time, interested in the question posed by "Yorkist," with regard to the effects of different head pressures on soundness. He points out that castings can often be made quite sound by adding a few inches of head pressure, in spite of the fact that the risers and gates are no bigger and, presumably, freeze up just as quickly as those with lower head pressure. "Apparently," he says, "the same amount of metal enters the mould in both instances."

Personally, I doubt whether the same amount does enter the mould in both cases, though the matter is difficult of proof or disproof. It is now an accepted commonplace that wherever solidification is proceeding, there is a drain of liquid to that part; from riser, runner or hotter part of the casting.

Consider, then, two similar castings with the same diameter runners and risers, cast at the same temperature, but one with a substantially higher head. Presumably the risers and runners will begin to freeze at the same time interval in both cases, and gradually close up at the same speed. But do they?

The first-formed dendrites must be very fine and very frail, gathering strength as they grow out to the centre of the runner or riser. With any given head

(*Continued at foot of next column.*)

DISPOSAL OF SURPLUS MACHINE TOOLS

The Machine Tool Control announces that the new arrangements designed to facilitate the disposal of Government surplus machine tools (*i.e.*, those not in the possession of contractors), in the interests of industrial re-equipment will come into operation on March 15. From that date stock records giving brief specification, price and location of every Government machine tool which becomes available for disposal by the Control will be maintained in each of the Machine Tool Control Offices in Birmingham, Bristol, Glasgow, Leeds and Manchester, as well as in London. Permits may then be obtained to inspect machines where they are stored.

Sales will be on a cash basis and each machine will be sold as inspected by purchaser and loaded on his vehicle at store. Purchasers will be required to give an undertaking that machines will be used in their business in the United Kingdom, and purchases of used machines for stock or re-sale will not be permitted. Every transaction will be directly between the Ministry of Supply and the user, and the price will be the same whether or not he decides to use the services of a merchant. A list of merchants holding such agreements will be available at each Machine Tool Control Regional Office.

These arrangements do not apply to Government-owned machine tools in the possession of contractors. These contractors should address any inquiries relating to such machines to the department with whom they hold an agreement.

LORD WOOLTON, Minister of Reconstruction, addressing members of the British Standards Institution recently, referred to trade prospects after the war. The world was very bare of goods, he declared, and domestic needs would be great. He hoped British industry would stand up to the high tradition of public service.

(*Continued from previous column.*)

pressure of liquid metal, the stem will seal up at a certain instant, *i.e.*, the strength of the forming crystals will be enough to prevent the passage through of liquid metal. Given greater head of liquid metal, however, it seems to me that the downward drift of metal will fracture the tender, newly-forming dendrites and drift them away, so that the stem gives passage for a longer time; consequently more metal does enter the casting proper in this case.

All this is hypothetical, but, I think, reasonable.—Yours, etc.,

JOHN LONGDEN.

11, Drumry Road,
Clydebank.
March 6, 1945.

THE SCOPE AND LIMITATIONS OF RADIANT HEATING IN DRYING PROCESSES

Methods which will find an important place in mass-production schemes

By H. SILMAN, B.Sc., F.R.I.C., A.M.I.Chem.E.

(*Continued from page* 198.)

Medium Temperature Gas-heated Unit

For industrial use more robust and cheaper radiant elements operating within a temperature range of 500 to 1,000 deg. C. have therefore been introduced. For paint and enamel stoving on light articles excessively high temperatures of the radiating surface are not required, and may in fact be disadvantageous, and for this purpose a cheap and efficient gas-heated unit has been described by Andrew and Chamberlain.[4] This is in the form of a tunnel and is especially suited to conveyorised work, the articles to be heated passing through the tunnel continuously. The construction of the unit is shown in section in Fig. 7.

The radiating surface is a bent black steel sheet, behind which is an insulating refractory back, leaving a tapered space between the sheet and the refractory 3¼ in. wide at the bottom and ¼ in. at the top. A bar burner carrying luminous jets which give a high rate of heat transfer to the radiating panel is situated at the bottom of the combustion space; to facilitate heat transfer at the top of the radiating panel the latter is ribbed on its face in this zone, whilst the lower part of the panel is protected by an inner sheet to prevent local overheating where the burners impinge. In this way a reasonably uniform panel temperature is obtained over its whole area, and this averages about 650 deg. F. (340 deg. C.). It will be seen that the simplicity of the design makes the cost of construction extremely low, and practically no maintenance is required. The oven can be built up in sections of any length, and several industrial units operating on a considerable scale have already been constructed. Fig. 8 shows a typical plant engaged in the stoving of small cup-shaped articles.

Measurements of radiating efficiency with this type of unit indicates that approximately 2,900 b.t.u.'s sq. ft. per hr. would fall on a panel suspended vertically inside a tunnel with a circular cross section 16 in. in diameter. Converting to electrical units, this corresponds to a radiating intensity of approximately 6 watts per sq. in. of the receiving surface as compared with 2¼ to 4 watts per sq. in. for the average tungsten filament type of plant. A corresponding reduction in the stoving time for painted surfaces is found also on account of the higher flux density emitted.

More recently the radiating panels in this type of unit have been constructed with corrugated surfaces giving a higher radiating efficiency, and a modified design of oven is described by Atkin[5] (Fig. 9). The cross-section is hexagonal, and the products of combustion are carried back from the top of the tunnel before discharge to clear the conveyor chain and to minimise heat losses. The corrugations not only increase the radiating efficiency, but the radiation is also more satisfactorily distributed to deal with surfaces which are not directly exposed to the radiating walls. The advantage of the corrugated surface is seen from the fact that in one test a 22-gauge black-painted panel 6 in. square was heated to 338 deg. F. in one minute using a corrugated radiating surface, whilst with a flat surface under similar conditions a temperature of only 292 deg. F. was attained in the same time. Further tests indicated that an appreciable saving in gas consumption can also be effected by using the corrugated surface.

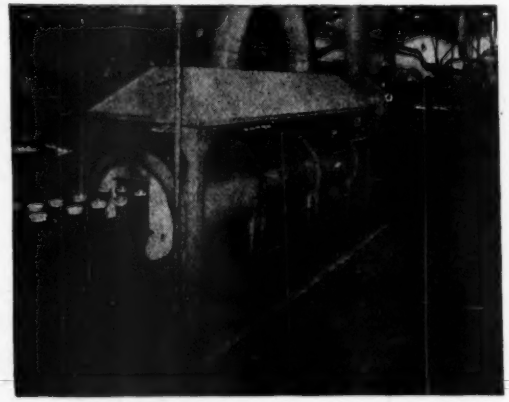

FIG. 7.—TUNNEL STOVE FOR CONTINUOUS CONVEYORISED PRODUCTION.

Atkin also describes a larger version of this type of tunnel, using tiers of burners instead of a single row at the bottom, and a full scale unit has been employed with some success in the stoving of finishes on motor-car bodies. In order to obtain uniformity of drying in tall tunnels, such as are necessary for this application, it was found desirable to arrange for a temperature gradient rising from 700 deg. F. (370 deg. C.) at the bottom of the panel to 450 deg. F. (230 deg. C.) at the top in order that the rate of

Radiant Heating in Drying Processes

heating of the body should be equalised. The boot and scuttle tended to heat up more slowly than the sides of the car, so that special measures to compensate for this effect have to be taken.

Dull Emitter Electric Radiators

Dull emitter electric radiating units have also been described recently.[6] These make use of wound elements embedded in a refractory and are rated at 700 watts. Behind these elements reflectors are mounted which may be of the square type giving the minimum of space for convection losses between adjoining reflectors. These reflectors are removable from the back for cleaning without disturbing the electrical connections or the heating elements. The units operate satisfactorily, and the elements have a very long life because of the low temperatures employed. Their output is adequate for raising the temperature of a surface to 300 to 400 deg. F. in a short time. By means of a resistance it is possible also to reduce or increase the temperature of the radiating element as required so that the plant acquires increased flexibility to meet special requirements. This unit has been found useful in the heating of pre-forms for the moulding of thermosetting plastics.

High-temperature Radiants

For certain types of work high-temperature radiating elements are desirable. If, for example, paint is to be stoved on heavy castings or forgings their mass will result in a considerable abstraction of heat by conduction into the body of the metal. A much higher radiant output will therefore be required if the object is to attain the necessary temperature in a reasonable space of time. One type of high temperature radiant panel which has been described[7] consists of vertical refractory rods placed in front of a refractory back, the space between the rods and the back being tapered. The heat is supplied from a bar burner (luminous type) located at the bottom of the panel. These panels can be employed either vertically or inclined at an angle and are capable of giving a maximum flux density of 25,000 B.T.U. per hr. The radiating efficiency is approximately 35 per cent., and the major part of the energy is radiated at between 15,000 and 16,000 Å. By the use of a pair of such radiant panels of this type each 104 sq. in. in area a 15-lb. casting was raised to 350 deg. F. in six minutes, as compared with 30 minutes in the medium-temperature oven already described.

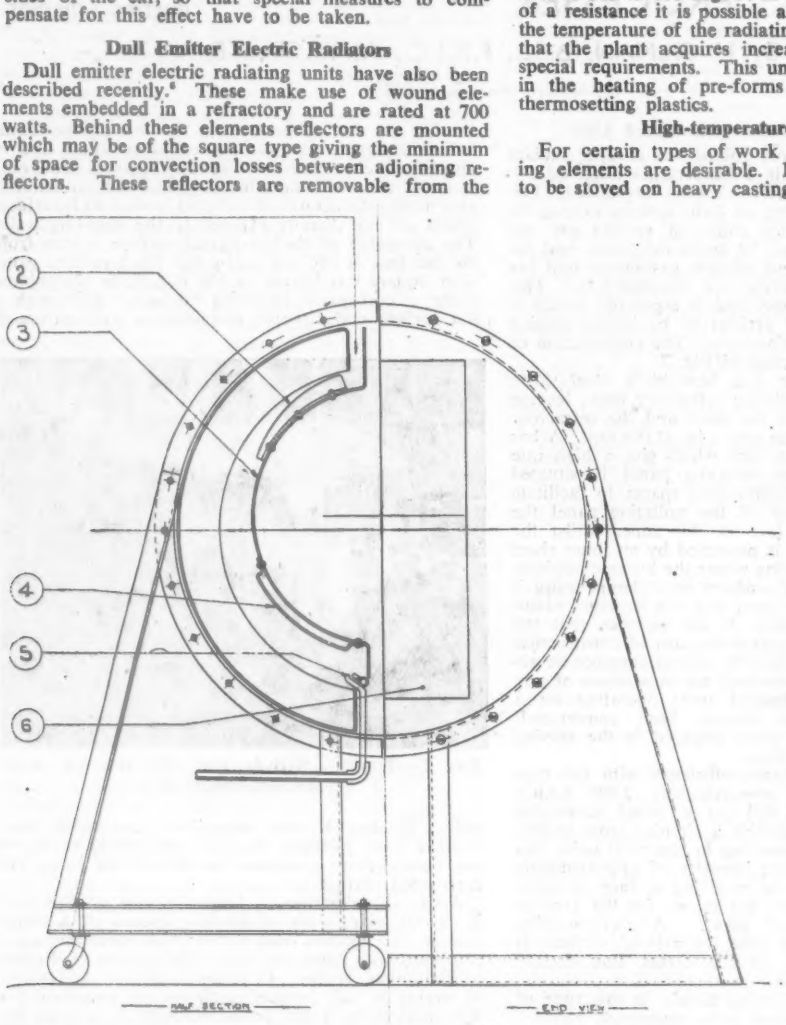

FIG. 8.—A TYPICAL PLANT ENGAGED ON THE STOVING OF CUP-LIKE COMPONENTS.

Another system makes use of the surface combustion principle in which an air-gas mixture is burnt on the surface of a refractory panel and is capable of giving radiant flux densities of 40,000 b.t.u.'s per sq. ft. per hour (equivalent to more than 80 watts per sq. in.). Naturally, this type of unit is best applicable where conditions are such that charring of the surface being heated is not likely to occur, *e.g.*, in the stoving of paint on heavy articles. The rate of heat input is so great that with rapidly heat-convertible paints baking is complete before the mass of the metal has obtained the temperature of the surface. This results in a substantial saving of time and fuel. Another system uses tunnels built up of refractory elements heated by gas or electricity to temperatures of the order of 1,000 deg. C. Paint is said to have been dried on solid steel cylinders 3 in. in diameter in a little over one minute. The time taken in an electric bulb plant would have been appreciably longer, whilst the usual convection oven would have taken about one hour.

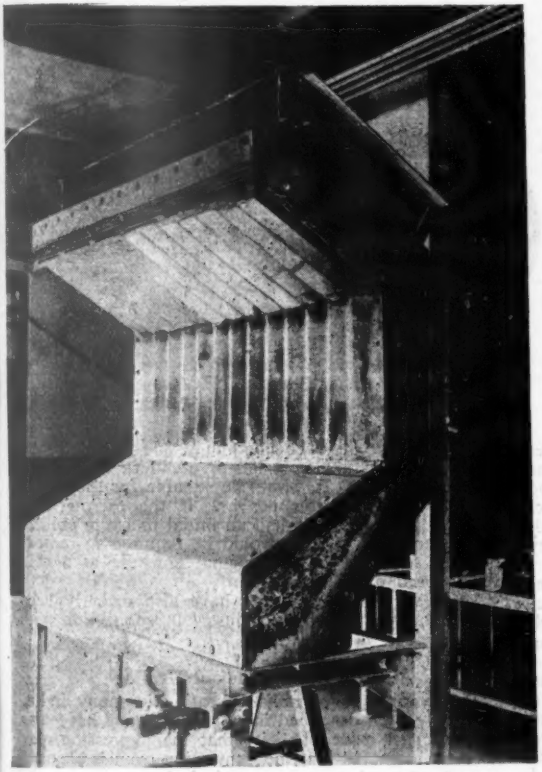

FIG. 9.—SHOWING THE INTRODUCTION OF CORRUGATED SURFACES TO INCREASE RADIATING EFFICIENCY.

The Burdett Burner

An interesting and very flexible form of gas-fired radiant heating unit is the Burdett burner, which has found its main application in the U.S.A. The construction of this burner is shown diagrammatically in Fig. 10. It consists essentially of an alumnite refractory disc burner using an air-gas mixture controlled by a proportioning valve and fed to it by a low pressure blower. Combustion takes place in the concave refractory disc so that convected and radiated heat are made full use of. The refractory disc operates at a temperature of about 1,250 deg. C., the gas consumption being from 10,000 to 320,000 b.t.u.'s per hr., depending on the size of the burners, which range from 2½ to 12 in. in diameter. Maximum operating temperature is reached in less than a minute from starting up. One advantage of the burner is that it can be operated at any angle, even inverted, and it can be automatically controlled by suitable thermostatic devices.

It has the limitations, however, that the products of combustion normally pass into the heated chamber. There are numerous drying processes in which it is undesirable that the products of combustion should enter the oven (*e.g.*, in the stoving of many types of paints and varnishes). Amongst the applications to which the Burdett burner has been applied are paint drying, die-casting and lithography in both direct heating and indirectly heated ovens. They have also been employed in the glass industry in the production chamber and in vitreous enamelling. Installations are also working in boiler plants.

Fig. 11 shows a British burner in which a high intensity radiating surface is produced by a small, high-pressure gas burner, which raises a metal disc made of heat-resisting alloy to a temperature of about 900 deg. C. The working pressure of the burner is about 3 lbs. per sq. in., the products of combustion are removed from the back and do not enter the oven, which is a considerable advantage. Stoves for the baking of enamels on massive metal parts have been constructed, using burners of this kind, and have given very satisfactory service.

Dehydration

The removal of moisture from surfaces and masses is a common industrial problem. Such processes as the manufacture of foods, ceramics products, welding electrodes, vitreous enamelling frits, and many others are concerned with this operation, and the possibilities of radiant heating in this field are worthy of consideration. No great amount of practical investigation has been carried out so far into the question, but the main principles involved are clearly understood. The requirements for rapid drying are twofold: (*a*) the articles must be raised in a temperature so that

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the water may be driven off quickly; and (*b*) a good flow of dry air should be maintained to carry off water which is liberated from the moist surface. In the convection oven the warm air serves both purposes inasmuch as the article to be dried is heated by the warm air, which also has a high capacity for taking up water vapour. By radiant heating, on the other hand, the first object, i.e., the heating of the surface is readily attained, but for maximum efficiency in the removal of moisture a high air temperature is also required in order that it may be able to take up an adequate amount of water. Some degree of air movement is also essential to facilitate the removal of the water vapour, since once the ambient atmosphere has become saturated it cannot take up any

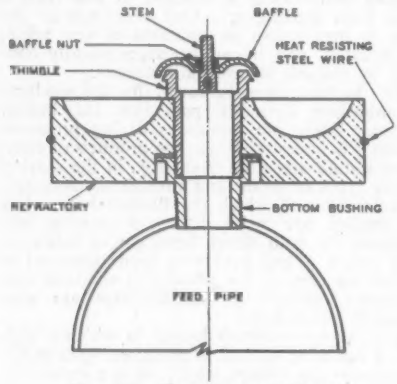


FIG. 10.—THE BURDETT BURNER.

FIG. 11.—A BRITISH BURNER, HAVING A HIGH INTENSITY RADIATING SURFACE.

further moisture at a given temperature, however long heating is continued. Ultimately the drying time by radiation depends on the quantity of heat absorbed by the drying material, and this in turn is a product of the energy input less the heat lost to the surrounding atmosphere (if any). Fortunately, the absorptivity of water in the infra-red region is good, so that generally it is to be expected that wet articles would likewise be good absorbers of radiant heat. This statement is, of course, subject to modification by such factors as the colour and reflectivity of the absorbing material.

The temperature distribution within any oven in which drying is being carried out will tend to be equalised as the water vapour enters the atmosphere within the oven; this will offset to some extent the poor heat conductivity of the general run of materials of this type which have to be dried. Atkin[8] has found considerable reduction in the time of drying out of components in the ceramic industry using gas-heated radiant ovens. Thus, small cylindrical forms 3 in. long by ¾ in. in diameter were dried satisfactorily in less than half-an-hour as compared with 5 hrs. in conveyorised convection oven with heated air blown in a counter-direction to the direction of movement of the conveyor. This was in order to produce a relatively high initial humidity at the commencement of drying which was originally considered necessary to promote uniform drying throughout the mass.

Some promising experimental work has recently been carried out in the U.S.A. on the dehydration of food products[9] using tungsten filament equipment. The effect of thickness on drying time is of interest; thus it was found that in dehydration of carrots 30 min. were required for the removal of 85 per cent. of the required moisture for 0.25 in. slices and only 5.3 min. for 0.044-in. slices. On a basis of their work it was computed that an oven containing 850 lamps of 250 watts each and having a length of 40 ft. and a conveyor width of 3½ ft. would be suitable for the drying of 225 lbs. of carrots per hr. If the carrots were cut into ¼-in. slices and had an initial moisture content of 87 per cent., 11 min. would be required to remove over 90 per cent. of the original moisture at a conveyor speed of 3½ ft. per min.

Some very promising tests have also recently been carried out in the textile industry in connection with cloth drying.

Limitations of Radiant Heating

The advantages of radiant heating in many industries have been described in some detail and have also received such wide publicity that the impression may have been created that the convection oven is obsolete for all practical purposes. This is by no means the case, as there are certain applications where better re-

sults and even more rapid outputs can be obtained from a convection oven.

The most important limitation of radiant heating installations of all kinds is the fact that articles being stoved in them must be exposed to the radiating surfaces. In the case of tungsten filament lamp installations we have seen that special reflectors are employed to ensure that the radiation is correctly directed. It is not, of course, essential that all surfaces should be directly facing the radiating source, because a certain amount of heat will be carried by conduction through the body of the object if this is constructed of metal which has good heat conductivity, for instance. In the case of poor heat conductors, however, transfer by this means is less satisfactory and direct impingement of the radiation on all surfaces to be heated becomes much more important.

In general, however, it can be said that with radiant heating the object must be substantially in sight of the radiating panels, reflectors, etc. This limits the shape of the oven, which must be relatively narrow and cannot usually take more than one row of the articles being stoved. This may be satisfactory in the case of finished products where the space loading factor is relatively low and the increased drying speed by radiation more than counter-balances the greater flexibility of disposition of the articles inside a convection oven. In other instances, however, the loading factor which can be obtained in a convection oven may be so high that radiant heating is at a decided disadvantage. A case in point is the stoving of paint on small flat sheets.

Articles Suited to Convection Ovens

These can be passed through a convection oven spaced 1 in. apart in a plane at right angles to the direction of movement of the conveyor. To take an example, if the stoving time were half-an-hour and the sheets were 1 ft. square, 36 such sheets could be dealt with in an oven of approximately 1 ft. cross section and having a length of 3 ft. A radiant stove, on the other hand, would be narrow, but would have to be 1 ft. high and 3 yds. long to deal with the same output; even the stoving time were reduced to 3 min. using the same conveyor speed. It is seen, therefore, that under present conditions such sheets are probably better dealt with in convection ovens. Other articles which are well suited to convection ovens are small stampings and pressings which can be loaded into such ovens with a minimum of space wastage.

A further limitation to the extended application of radiant heating as compared with convection ovens is the fact that, generally speaking, the best results are obtained when large numbers of similar articles have to be stoved. Where smaller quantities of variable types of articles have to be dealt with non-uniform drying is apt to be obtained, or certain types of paints may be charred or discoloured. Low-temperature gas ovens with good insulation are superior in this respect to tungsten filament installations, but nevertheless this limitation is still of importance. The extension of the use of radiant heating to miscellaneous types of articles is to some considerable extent dependent on improvements in paint characteristics. The chief requirement is a type of paint which will have a much wider stoving range than those available at present. In other words paints are needed which will not discolour or char even if considerably over-stoved. This is necessary in order that parts of the articles which are not directly exposed to radiation or are more massive than others may be dried without injury being done meantime to those areas already fully cured.

Capital Cost

For dehydration and water-removal generally an important limiting factor will be capital cost. High intensity radiant units are expensive to construct as compared with hot-air ovens. The latter are readily built from cheap constructional material, and when correctly designed they function efficiently, and, moreover, have a long life. Radiant plants, although they may result in a faster rate of heat input, utilise considerable amounts of fuel in a short time, and unless the articles being heated are located so that the optimum absorption of the radiation takes place, running costs may also be found to be somewhat high.

It can be said, on the whole, that the advent of radiant heating technique into the metal finishing field in particular has considerably influenced ideas on oven design and drying processes, but the early enthusiasm which foresaw the speedy replacement of all types of ovens by batteries of electric bulbs has now disappeared. Radiant heating methods in the fields dealt with in this Paper will undoubtedly find an important place in mass-producing factories, but their range of employment will probably be limited to specific and fairly well-defined applications, and they will not displace convection ovens for a very great many purposes.

REFERENCES

[4] Andrew and Chamberlain.
[5] F. L. Atkin. "Gas Times," Sept. 16, 1944. Supplement I.
[6] E. C. Malins. "Machinery" (1943), 15, No. 24.
[7] Andrew and Chamberlain, *loc. cit.*
[8] F. L. Atkin, *loc. cit.*
[9] F. M. Tiller, E. E. Litkenhous and W. Turbeville Food Industries Oct, 1943.

NOTES FROM THE BRANCHES

EAST ANGLIAN SECTION.—To a Council meeting, held on February 21, it was reported that activities would be resumed on March 22, when the annual general meeting would be held. From that time onwards, meetings were being spaced out so as to allow the return to the normal schedule of monthly meetings in the winter. A full programme has been arranged as far ahead as March, 1946.

MR. E. I. BRIMELOW, M.Eng., formerly research metallurgist at the Royal Aircraft Establishment, Farnborough, has been appointed research and development manager of Specialloid, Limited.

WORK-HARDENING AND THE RE-ANNEALING OF IRON

An account of an extensive investigation into the changes in various properties of Armco-iron wires resulting from twelve different degrees of work-hardening, and subsequent annealing in a vacuum, forms the subject of an Iron and Steel Institute Paper entitled "A Study of Work-hardening and Reannealing of Iron," submitted by M. BALICKI, DR.-ING. (MET.). In the work particular care was taken to secure comparable sets of results. On the same samples, or on exactly similar material, the following properties were determined: Hardness, electrical resistivity, elastic limit from the bend-test, plastic limit, ultimate stress, uniform elongation, springiness, thermo-electric properties and microstructure. Attention was paid to the effect of the time of annealing and to the order of the inaccuracy caused by ageing. Some other effects of which account should be taken are also indicated in the Paper. A survey of the changes induced by reannealing confirms the presence of three phenomena: Strain-ageing, recrystallisation and crystal growth.

The main change, that of recrystallisation, of a work-hardened wire is shown by all the curves as occurring in the same range of temperatures (which is contrary to the findings of Tammann); this suggests that all the changes are a result of the same fundamental cause. The recrystallisation range is lowered when the degree of work-hardening is increased. From the change in the course of the curves which characterise work-hardening iron three regions of plasticity were distinguished.

A short description of the practical view of work-hardening is given in the Paper, and also an account of the theory of recrystallisation developed by Krupkowski and the author. The applicability of the theory to the experimental results is demonstrated by recalculation of some of the experimental curves. The calculated and experimental values show satisfactory agreement, although not as good as was previously obtained when copper and nickel were similarly treated. Evidence is produced that irregularities are caused by strain-ageing. A point of theoretical importance is that the energy of activation of the recrystallisation process of iron is independent of the degree of reduction and is nearly the same (31,000 cals. per mol) as previously determined for copper (33,000 cals. per mol) and nickel (32,400 cals. per mol). The frequency coefficient c is found to depend upon the degree of cold-work in a similar manner to that in which certain properties increase with increasing degrees of reduction. The value of c depicts the nature and the history of the metal.

TEES-SIDE CHAMBER OF COMMERCE are urging the Government to include an enabling clause in the Distribution of Industries Bill granting permission to all local authorities to make contributions to Industrial Development Boards.

NEWS IN BRIEF

IT IS ANNOUNCED that Morris Motors, Limited, is to operate a large factory near Llanelly.

T.V. TOOLS, LIMITED, is being wound up voluntarily. Mr. A. G. White, 73, Cheapside, London, E.C.2, is the liquidator.

IT IS DISCLOSED by the Tees-side Industrial Development Board that ten inquiries for industrial sites—some of a substantial nature—have been received, including one for a new shipyard.

MR. G. R. T. TAYLOR, chairman of International Combustion, Limited, in his statement accompanying the annual report, says that orders on hand are by far the highest in the annals of the company.

A WHITE PAPER issued by the Government of Eire states that for the proposed eight-year plan of post-war building and constructional work by the Government and other public bodies, £100,000,000 will be required.

THE DIRECTORS of the British Aluminium Company, Limited, propose to revise the articles of association to provide for an increase in the permitted number of directors from nine to 12 and to amend the method of paying fees.

SEPARATE MEETINGS of the preference and ordinary shareholders and an extraordinary meeting of the Zinc Corporation, Limited, in London, recently, approved the directors' capital reorganisation proposals by large majorities.

LEEDS CORPORATION ELECTRICITY COMMITTEE has accepted the tender of Ferguson, Pailin, Limited, Manchester, for generator switchgear at £10,846 and works transformer switchgear at £10,063 in connection with additions to the Kirkstall power station.

AN INDICATION of the extent of the war effort of Hepworth & Grandage, Limited, manufacturers of piston rings, pistons, cylinder liners, etc., of Bradford, is given by the fact that the firm's consumption of gas has increased by 3,000 per cent., that of electricity by 500 per cent., the number of employees has grown by 400 per cent. The area of the factory has doubled.

SIR MARK HODGSON, general secretary of the Boilermakers' Society, says that from his experience as a member of the Shipbuilding Advisory Committee, the prospects for the shipbuilding industry are fairly good, at least for several years. Estimates that the United States will have a merchant fleet of some 6,000 ships at the end of the war, compared with 1,000 before, he does not fear, as he still thinks this country has the premier shipbuilding industry of the world.

AFTER LONG DELAYS, chiefly arising through war conditions, one open-hearth furnace is ready for operating at the Haulbowline works of Irish Steel, Limited, but the manufacture of steel ingots is being held up by lack of trained workers. A second furnace will be completed as soon as circumstances admit. In the meantime, the Supply Department is making every effort to accumulate a sufficient supply of iron and steel scrap to keep the furnace and the second one in operation.

The High-Quality Iron for High-Duty Castings.

Made in seven standard grades or to individual requirements, this iron has a close grain structure and fine graphitic carbon content. It replaces Hematite, and tones up high phosphorus irons.

We also make Dale Refined Malleable Iron to any required specification.

PERSONAL

MR. C. H. ARNOLD has been appointed a director of Kayser, Ellison & Company, Limited, in place of Lieut.-Col. Frank Kayser, who has resigned.

SIR JAMES PRINGLE is relinquishing the appointment of Director of Electrical Engineering to the Admiralty on March 31. He will be succeeded by MR. H. D. MACLAREN, who is at present the acting Assistant Director of Electrical Engineering.

MR. W. R. BERRY, chief development engineer to Jonas Woodhead & Sons, Limited, spring manufacturers, of Leeds, has been appointed a director of Ibbotson Bros. & Company, Limited, steelmakers, etc., of Sheffield, which is controlled by Jonas Woodhead & Sons.

MR. J. D. CARMICHAEL, O.B.E., A.M.I.Mech.E., managing director of Carmichael Bros, Limited, South Shields, who has held the office of President of the National Ironfounding Employers' Federation for the past four years, has been re-elected for a further term of office.

MR. ANDREW K. MCCOSH, President of the Mining Association of Great Britain, has been elected President of the British Employers' Confederation, in succession to the late Sir Charles Craven. He is chairman of Bairds & Scottish Steel, Limited, and other companies.

MR. W. KILPATRICK has resigned his position as managing director of the Davy & United Engineering Company, Limited, and has also resigned his seat on the board of that company and its subsidiaries, Duncan Stewart & Company, Limited, and Davy & United Roll Foundry, Limited.

MR. L. G. A. LEONARD, late assistant general manager of British Furnaces, Limited, of Chesterfield, has been appointed general manager of the Dowson & Mason Gas Plant Company, Limited, of Manchester, in succession to MR. JAMES PATON, who is retiring after having held the post since 1917. Mr. Paton retains his seat on the board.

MR. LESLIE GAMAGE has been re-elected president of the Institute of Export for the third year. He is joint managing director of the General Electric Company, Limited. MR. A. G. B. OWEN, managing director of Rubery, Owen & Company, Limited, and chairman of the Brooke Tool Manufacturing Company, Limited, and CAPT. J. FOX-WILLIAMS, M.C., managing director of Williams & Williams, Limited, have been elected vice-presidents.

MR. C. PRYKE, who joined the Hoffmann Manufacturing Company, Limited, in 1901, and has been a director and comptroller, is retiring from his executive position at his own request, but is retaining his seat on the board and has been appointed vice-chairman of the company. COMMANDER A. F. ARMITAGE, R.N., a director and the general manager, has been appointed managing director. MR. W. L. HUBBARD returns to the company and has been appointed commercial manager.

MR. H. L. SATCHELL has been appointed manager of the Rugby works of the British Thomson-Houston Company, Limited, in succession to MR. A. P. YOUNG, who has retired after 44 years' service. Mr. Satchell took up an apprenticeship with the company in 1920. He was appointed assistant manager of the Rugby works in 1940 and associate manager early this year. Mr. Young has received presentations from various sections of the company.

MR. ERIC MENSFORTH has been released at his own request from his duties as Chief Production Adviser to the Chief Executive of the Ministry of Aircraft Production. He has been attached to the Ministry since June, 1943, and in accepting his resignation Sir Stafford Cripps, Minister of Aircraft Production, has expressed his appreciation of the very valuable services rendered by Mr. Mensforth in connection with the great expansion of aeroplane production. Recent developments have made it possible for the Minister to release Mr. Mensforth so that he may devote himself fully to his duties as director of Westland Aircraft, Limited, and deputy managing director of Thos. Firth & John Brown, Limited, but he will continue to assist the Ministry from time to time on particular matters in which his wide experience enables him to advise with special authority.

Wills

SHORTER, A. E., of Sheffield, managing director of the Shorter Process Company, Limited ... £7,646

CRAVEN, COMMANDER SIR CHARLES W., Bt., chairman and managing director of Vickers-Armstrongs, Limited, chairman of the English Steel Corporation, Limited £79,177

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

566,678 BRITISH THOMSON-HOUSTON COMPANY, LIMITED, and HOLME, T. Methods of electrically welding heavy sections of metal.

566,717 MORTON, L. Travelling grates for furnaces.

566,765 JAMES, H. LESLIE. Impregnation of hollow metal castings.

566,838 BARRATT, W. G., and HALSALL, J. Y. M. Furnaces of intermittent ovens and kilns for firing ceramics.

566,866 RADIO CORPORATION OF AMERICA. Method of and apparatus for heat-treating metal.

566,885 ELECTRIC RESISTANCE FURNACE COMPANY, LIMITED, and SMITH, R. A. Electric furnaces of the salt-bath type.

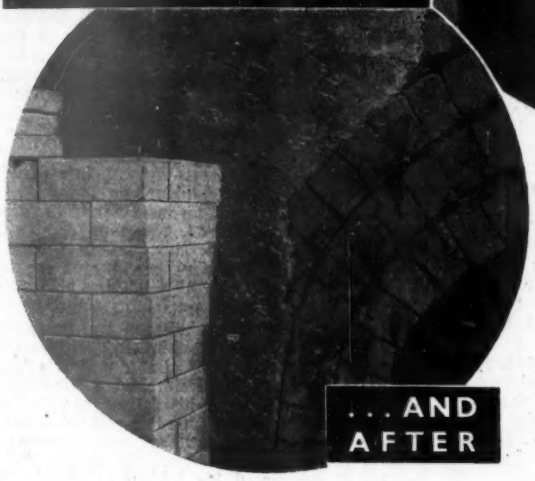
AT THE MONTHLY MEETING of the Institution of Production Engineers (Wolverhampton branch), held at Walsall, Mr. T. G. Bamford, Principal of the County Technical College, Wednesbury, gave a lecture on "Metallurgy and the Production Engineer."

Patch

WORN FURNACE BRICKWORK WITH

Durax No. 1

PLASTIC FIREBRICK COMPOSITION



WHEN quick repairs to worn furnace brickwork are required, Durax No. 1 provides an excellent patching medium. It is supplied in a stiff, plastic condition ready for use. It possesses exceptionally high refractoriness, negligible shrinkage on drying, and good resistance to thermal shock.

Durax No. 1 is also frequently used as a rammed monolithic lining in small size furnaces, such as crucible furnaces, owing to the ease of installation — the avoidance of special shapes—and because it provides a strong, durable structure. Users who require further information concerning the uses of Durax No. 1 should communicate with the G.R. Technical Department.

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FIREBRICKS · BASIC BRICKS · ACID-PROOF MATERIALS · CEMENTS

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COMPANY RESULTS

(Figures for previous year in brackets.)

Heenan & Froude—Interim dividend of 5% (same).

Thos. W. Ward—Interim dividend of 3¼%, less tax (same).

National Gas & Oil Engine—Profit for 1944, £45,569 (£47,263); dividend of 5% (same).

G. D. Peters & Company—Final dividend of 7½%, making 15% (same), and a special cash bonus of 2½% (same).

Wheal Reeth Tin—Loss for 1943, £1,265 (including debenture interest of £1,440 unpaid), increasing debit balance to £28,651.

Cammell Laird—Net profit for 1944, £197,575 (£199,292); to general reserve, £100,000 (same); final dividend of 6% (same), making 10%, less tax (same); forward, £125,350 (£116,525).

Baldwins (Holdings)—Profit for 1944, after providing for taxation on the basis of a continuing business, £419,667 (£383,659); dividend of 10% (same); depreciation, £175,000 (same); directors' fees, £5,477 (£6,150); net profit, £239,190 (£202,509).

Zinc Corporation—Dividend of 2s. per share (same), English currency, being the second half of the fixed cumulative dividend on the preference shares, and an interim participating dividend of 1s. per share (same), English currency, on both the preference and ordinary shares.

International Combustion—Net profit, before taxation, for the year to September 30 last, including those of subsidiary companies, £218,368 (£212,249); taxation, £127,361 (£105,860); provision for undue wear and tear of plant and machinery, nil (£20,000); ordinary dividend and bonus of 33¼% (30%); forward, £91,170 (£61,813).

Bruce Peebles & Company—Profit for 1944, after taxation, etc., £42,554 (£39,737); ordinary dividend of 5% and bonus of 3% (same); dividend on the 7½% cumulative participating preference stock for 1944, together with a participating dividend of 2½%, making 10% (same); to depreciation, £20,000 (same); forward, £15,506 (£12,282).

Thomas Robinson & Son—Profit for 1944, £61,848 (£143,432); directors' fees, £1,350 (£1,200); depreciation of fixed assets, £9,570 (£9,244); war damage insurance, £333 (£1,833); provision for taxation, £21,000 (£100,000); net profit, £29,595 (£31,155); preference dividend, £11,250 (same); ordinary dividend of 7½%, £16,619 (same); forward, £42,644 (£40,918).

General Refractories—Trading for 1944, including profits of the United Kingdom subsidiaries, £186,125 (£228,283); interest, £3,038 (£3,437); deferred repairs, £3,000 (nil); depreciation, £39,126 (£39,222); A.R.P., nil (£2,916); taxation and E.P.T., £85,140 (£130,722); profits attributable to outside interests, £2,880 (£2,583); net profit, £52,941 (£49,403); to war damage insurance, £917 (£1,528); to general reserve, £35,000 (£25,000); to credit surplus taxation reserve, £9,000 (nil); dividend of 7½% (same); forward, £55,669 (£54,033).

OBITUARY

MR. ARCHIBALD HORNAL, assistant general secretary of the Association of Blacksmiths and Forgeworkers, died recently.

MR. JAMES L. ASHLEY, a director of the International Nickel Company of Canada, died in New York recently. He was 76.

LT. N. J. MANDER, who, until the outbreak of war, was the publicity manager of the London office of Aluminium Union, Limited, died of wounds in Burma on January 31.

MR. F. W. MALE, managing director of F. W. Male & Son, Limited, ironfounders, welders, etc., of Cartwright Street, Wolverhampton, which he founded in 1899, died on March 1, aged 79.

MR. H. H. GREEN, founder and former managing director of H. H. Green & Russell (1940), Limited, malleable-iron founders, of Wolverhampton, has died. He was 84 and retired about 20 years ago.

MR. JOHN SMITH, a local director and formerly a commercial manager of Thos. Firth & John Brown, Limited, Sheffield, with whom he had served for 26 years, has died, aged 74. He played an important part in the successful marketing of Firth stainless and "Staybrite" steels, and is said to have been responsible for the name "Staybrite."

SIR DUNCAN RANDOLPH WILSON, late Chief Inspector of Factories, died suddenly on March 1. Born in 1875, he was appointed an inspector of factories under the Home Office in 1904, becoming deputy chief inspector in 1930 and chief inspector in 1932, a post he held until 1940. He was secretary of the Industrial Health Research Board, 1918-30, and chairman of the Home Office committee on factory lighting.

MR. GEORGE KEITH, chairman and managing director of Keith Blackman, Limited, engineers, etc., of Tottenham, London, N.17, died on March 5. He was 69 years of age. Mr. Keith had a life-long connection with the company, his father, Mr. James Keith, having been one of its founders. He devoted himself unsparingly to the interests of the company, particularly on the technical side. He joined the firm in 1893 and celebrated his jubilee in 1943. He was elected chairman and managing director in 1929.

HAND-TOOL MANUFACTURERS UNITE

At the recent inaugural meeting of the Federation of British Hand Tool Manufacturers, Mr. H. Clayton, the chairman, pointed out the necessity for the industry maintaining in the post-war period the unity and co-operation achieved under wartime conditions. He said that the Federation would be an important element in fostering the future prosperity of the trade, not only of the manufacturers who would comprise the membership of the new organisation, but also of the workpeople. It was announced that the Federation already had the support of nearly 350 firms, and it was anticipated that the co-operation of all the remaining units in the industry would be obtained.

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Raw Material Markets

IRON AND STEEL

Foundry pig-iron prices are raised by 15s. per ton under the Control of Iron and Steel (No. 40) Order, 1945, which came into operation on March 12. Cast-iron pipes and iron castings also are increased in price, mainly as a result of the higher pig-iron prices. There are reductions in prices for forging ingots and alloy steel and increases for tubes and certain classes of steel wire and wire rope. Maximum prices are provided for the first time for hot-finished and cold-drawn tubes to Admiralty specifications and for cast-iron brake drums.

Hematite pig-iron has been increased by 15s. a ton; foundry and forge pig-iron, low-phosphorus foundry pig-iron, Staffordshire blast-furnace low-phosphorus foundry pig-iron, and Scotch foundry pig-iron are all advanced 15s. Cylinder and refined irons and refined malleable are raised 6s., and cold-blast pig-iron by 15s. a ton. Forging ingots are reduced 10s. and gun billets 15s. 6d. a ton. All prices of alloy steel billets and bars are 13s. to 15s. 9d. a ton lower. Alloy steel wire rods are 14s. 3d. and alloy shell steel 13s. to 20s. 9d. down.

Under the related schedules, prices of cast-iron drain pipes are increased by approximately 4 per cent. Vertically-cast iron pipes, spun iron pipes and standard socket and spigot special iron castings are increased by approximately 10 per cent., while the discount off standard list for malleable-iron pipe fittings is reduced by 2½ per cent. Angle cast pipes for gas and water purposes are increased by 12s. 6d. per ton. Maximum prices for cast-iron brake drums are established for the first time. The percentage addition on rainwater and soil goods has been increased to 45 per cent. Basic pig-iron is now quoted at £6 15s. 6d., against £6 0s. 6d.

The price changes now announced are unlikely to affect market conditions to any great extent. Foundry owners cannot but regard with regret the further increase in the price of their raw materials, but it had been recognised for a long time that costs at the blast furnaces had increased considerably, and the advance in iron prices is hardly surprising in the circumstances.

The variety and extent of the claims on war transport apparently preclude any expansion in the imports of foreign ore. It is, however, an objective which is constantly kept in mind, since the use of so much native ore of low iron content involves a higher consumption of fuel than would otherwise be necessary. To achieve an approximate balance between pig-iron production and consumption, some curtailment of licensed tonnages has recently been necessary, but there is no evidence that industrial operations have been impeded by any shortage of iron. As heretofore, use of hematite is only authorised in special cases, but licensed tonnages of all other grades of iron are being regularly forwarded.

Although shipbuilders' requirements are on a reduced scale, the range of business in finished iron is not unsatisfactory. Not only are common iron bars moving off more freely, but there has been a slight improvement in best iron.

During the past few weeks there has been an exceptionally heavy run on sheet bars, and there is as yet no indication that saturation point has been reached. In point of fact, a brisk demand extends over practically the whole range of steel semis, with small billets particularly scarce. Wire rods are also in brisk demand, while defective billets, double-sawn crops, etc., are extensively used to eke out the available supplies of primes.

The lack of full employment for the heavy mills engaged on plates and sections affords an opportunity for developing the export trade, which is at last apparently attracting attention. There are many obstacles, of which the most formidable may be the provision of shipping facilities, but export opportunities undoubtedly exist and may be developed. Meanwhile, it is the lighter mills which are getting all the sunshine.

NON-FERROUS METALS

There have been no new developments in the non-ferrous metal markets. The requirements of the war factories are being readily met, but trading in other directions is on quiet lines. All transactions are, of course, subject to control. Imports are regulated and prices are fixed, and altogether the trade in non-ferrous metals is closely regimented. Care will need to be exercised in the distribution of tin so long as hostilities continue in the Far East, but it may be expected that releases of copper, lead and zinc for ordinary manufacturing purposes will be increased once the German war has ended. Aluminium is fairly freely available, and its use will undoubtedly be stimulated by the reduction in price recently announced.

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